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China occupies a contested space in the international efforts to address the problem of climate change. That position is explained by three simple facts. First, China is the world's leading emitter of greenhouse gases. Second, China is not subject to any of the regulatory restrictions imposed by the Kyoto Protocol on the emission of greenhouse gases. Third, China is a popular location for emissions reduction projects authorized by Kyoto's Clean Development Mechanism (CDM). Whether these three facts will continue to describe China will explain the success of international efforts to address climate change after Kyoto expires by its own terms in 2012.

The absence of restrictions upon China's emissions played a key role in the decision of the United States not to approve the Kyoto Protocol. That China has since surpassed the United States as the world's leading greenhouse gas emitter has fueled further complaints about China's status. For its part, China insists that its status as a developing country justifies the absence of international regulatory restrictions and that it has pursued an ambitious domestic program to reduce its greenhouse gas emissions. China is unlikely to agree to the same regulatory restrictions as those imposed upon the United States and other developed countries; likewise, the United States may be unwilling to agree to an international climate change regime that does not regulate China's emissions. The tension is exacerbated by China's calls for more sweeping reductions in greenhouse gas emissions than the United States has been willing to accept.[1]

The CDM plays a potential mediating role in this dilemma. The CDM allows developed countries to satisfy the greenhouse gas emission limits that Kyoto imposes upon them by funding projects that reduce greenhouse gas emissions in developing countries. The goal of the CDM is to reduce greenhouse gas emissions in the most efficient manner possible, and often that means subsidizing new projects in developing countries rather than retrofitting existing infrastructure in developed countries. But the CDM has been subject to a variety of criticisms to which the experience in China attests. Many of those criticisms question whether the CDM efficiently produces real reductions in greenhouse gas emissions.[2]

My focus in this essay is on how the CDM has subsidized the construction of so many new hydroelectric facilities in China, and the consequences – positive and negative – of those dams. This essay proposes an alternative approach that

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[1] *See infra* text accompanying notes 32-33.

[2] *See infra* text accompanying notes 25-31.

would shift more of the CDM resources to other nations and to renewable energy projects besides dams. The premise of the CDM is that the reduction of one ton of greenhouse gases should be treated the same regardless of where or how it happens. This makes perfect sense from the perspective of atmospheric science, as emissions from any place and any source soon mix with greenhouse gases throughout the earth. But climate change is about more than just atmospheric science. Not all countries are equal with respect to energy development and attendant greenhouse gas emissions, neither are all alternatives to burning fossil fuels equal in their environmental consequences. The CDM has neglected these differences even though the Kyoto Protocol specifies that sustainable development is one of the purposes of the CDM.

My proposal is that the CDM should discount hydroelectric projects in China so they receive less credit. More generally, the CDM should be modified so that it distinguishes between rapidly developing countries and the least developed countries, as well as distinguishing between projects that provide the greatest benefit to sustainable development and those that reduce greenhouse gas emissions while not otherwise aiding sustainable development. This idea draws upon the work of a number of writers who have proposed that various discounting factors should be introduced into the CDM. As applied to my focus upon the extent of a country's development and upon the contribution to sustainable development, a multiplication factor could be employed so that, for example, a wind power project in the African nation of Chad earns 1.75 credits for every one ton of greenhouse gas emissions that it avoids, while a hydroelectric dam in China earns only .71 credits for every ton of avoided greenhouse gas emissions. Such changes would enable the CDM to award more credits to projects in the least developed countries, and to projects that have the least harmful environmental consequences.

I. The Response to Climate Change

"CLIMATE CHANGE refers to any significant change in measures of climate (such as temperature, precipitation, or wind) lasting for an extended period (decades or longer)."[3] The basic science behind the earth's retention of heat is as follows:

> Energy from the Sun drives the Earth's weather and climate. The Earth absorbs energy from the Sun, and also radiates energy back into space. However, much of this energy going back to space is absorbed by "greenhouse" gases in the atmosphere. . . . Because the atmosphere then radiates most of this energy back to the Earth's surface, our planet is

[3] EPA, Climate Change, Basic Information, http://www.epa.gov/climatechange/basicinfo.html (last visited Oct. 12, 2009) [hereinafter EPA's Basic Information]; *see also* John Copeland Nagle, *The Evangelical Debate Over Climate Change*, 5 U. ST. THOMAS L.J. 53 (2008) (providing insight into the contemporary relationship between religious faith and public policy by discussing the contrasting views within the evangelical community to lead to more thoughtful responses to climate change, a more constructive engagement between evangelicals and environmental activists, and a deeper understanding of the relationship between religious teachings and environmental protection).

> warmer than it would be if the atmosphere did not contain these gases. Without this natural "greenhouse effect," temperatures would be about 60°F lower than they are now, and life as we know it today would not be possible.[4]

These "greenhouse gases" include carbon dioxide, methane, nitrous oxide, and fluorinated gases. Such gases exist naturally in our atmosphere. Changes in the sun's intensity, the earth's orbit, the ocean's circulation, and volcanic eruptions are among the natural factors that can change the climate. Also, human activities such as the burning of fossil fuels, deforestation, reforestation, urbanization, and desertification can affect the climate as well.[5] The Intergovernmental Panel on Climate Change (IPCC) concluded in 2007 that human activity has "very likely" caused most of the rise in temperatures since 1950.[6]

The effects of climate change could include flooding in coastal areas, droughts, heat waves, cold spells, extinction of species, and the spread of diseases. The IPCC's 2007 report concluded that "changes in arctic temperatures and ice, widespread changes in precipitation amounts, ocean salinity, wind patterns and aspects of extreme weather including droughts, heavy precipitation, heat waves and the intensity of tropical cyclones" have already been observed.[7] Many people already fear that climate change could work far more dramatic changes in the future. Al Gore's *An Inconvenient Truth*, for example, suggests that climate change could displace 20 million people from Beijing, 40 million from Shanghai, and 60 million from Calcutta and Bangladesh. A number of scientists and policy makers, however, contest these more apocalyptic scenarios.[8]

Such concerns prompted the United Nations to authorize an Intergovernmental Negotiating Committee on Climate in 1990 to begin discussions of a global treaty to address climate change.[9] These negotiations culminated in the 1992 United

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[4] EPA, Climate Change - Science, http://www.epa.gov/climatechange/science/index.html (last visited Oct. 12, 2009); *see also* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, Climate Change 2007: The Physical Science Basis. Contribution of Working Group 1 to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change 98 (S. Solomon et al. eds., Cambridge University Press 2007) (describing the greenhouse effect), *available at* http://ipcc-wg1.ucar.edu/wg1/Report/AR4WG1_Print_FAQs.pdf.

[5] EPA's Basic Information, *supra* note 3.

[6] INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 4, at 2–5, *available at* http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf. "Most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations." *Id.* at 10, *available at* http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf.

[7] *Id.* at 7, *available at* http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf.

[8] *Compare* AL GORE, AN INCONVENIENT TRUTH: THE PLANETARY EMERGENCY OF GLOBAL WARMING AND WHAT WE CAN DO ABOUT IT 204-06 (Rodale 2006), *and* BJORN LOMBORG, COOL IT: THE SKEPTICAL ENVIRONMENTALIST'S GUIDE TO GLOBAL WARMING (Alfred Knopf 2007).

[9] J.B. RUHL, JOHN COPELAND NAGLE & JAMES SALZMAN, THE PRACTICE AND POLICY OF ENVIRONMENTAL LAW 1329-32 (Foundation Press 2008) (discussing much of the background of the Kyoto Protocol).

Nations Framework Convention on Climate Change (UNFCCC).[10] The UNFCCC's central objective is to achieve "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."[11] The UNFCCC did not impose any actual regulations intended to achieve that goal, though it did oblige developed countries to "adopt national polices and take corresponding measures on the mitigation of climate change."[12] Developing countries were exempt from that obligation. The justification for the distinction appears in the UNFCCC's embrace of the principle of "common but differentiated responsibilities,"[13] which means that every country has a responsibility to address climate change but that the nature of that response will vary depending upon the circumstances of the country. The UNFCCC also adopts the precautionary principle and supports sustainable development.[14]

Five years later, the parties negotiated the Kyoto Protocol to the UNFCCC.[15] The Protocol imposes binding emission reduction targets on developed countries (known as Annex I parties), while no such reductions are required of developing countries (known as Annex II parties). The reduction targets must be met over a five-year commitment period (from 2008 to 2012) and is to be followed by subsequent commitment periods and presumably stricter emission targets. The issue of emission targets for developing countries was hotly contested during negotiations. The Kyoto Protocol did not address emission reductions for developing countries based on the reasoning that developed countries have been responsible for the lion's share of emissions to date and are better able to pay for reductions. Indeed, a proposal that would have established procedures for developing countries to take on *voluntary* commitments for emission limits was not even adopted.

The Protocol also contains several flexibility mechanisms that allow parties to meet their commitments together. *Emissions trading* allows a developed country to purchase or otherwise transfer part of its assigned amount to another developed country in exchange for payment.[16] For example, assume Country A has excess reductions under Kyoto (e.g., it has reduced its emissions by 200 tons compared to its 1990 emissions, and this is 40 tons more than required to meet its Kyoto reduction target of 160 tons), it can then sell its remaining emissions (up to 40 tons) to Country B. These can then be subtracted from Country B's total emissions in calculating its emissions under Kyoto.

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[10] United Nations Conference on Environment and Development, June 4-14, 1992, *United Nations Framework Convention on Climate Change*, U.N. Doc. A/AC.237/18 (Part II)/Add.1 (May 9, 1992), *available at* http://unfccc.int/resource/docs/convkp/conveng.pdf.

[11] *Id*. art. 2.

[12] *Id*. art. 4(2)(a).

[13] *Id*. pmbl.

[14] *Id*. at art. 3(3), 3(4).

[15] Kyoto Protocol to the United Nations Framework Convention on Climate Change, UN Doc FCCC/CP/1997/7/Add.1 (Dec. 11, 1997), *available at* http://unfccc.int/resource/docs/convkp/kpeng.pdf [hereinafter Kyoto Protocol].

[16] *Id.* at art. 17.

Like emissions trading, *joint implementation* may take place only between developed countries. Joint implementation involves the sale of "reduction units" from one developed country or private enterprise to another developed country or enterprise. Joint implementation thus enables one developed country to take credit for a project in another developed country. For example, the Netherlands has received credits toward its emissions requirements by subsidizing a new wind farm in Lithuania.[17]

The third flexibility device, the Clean Development Mechanism (CDM), has been dubbed the surprise of the Kyoto Protocol negotiations.[18] The CDM emerged as a compromise for accommodating the preference of the United States to use market-based tools and the developing nations' call for technology assistance. The CDM allows developing countries to help developed countries meet their emission reduction commitments. Article 12 of the Kyoto Protocol states that the dual purposes of the CDM are to assist developing countries "in achieving sustainable development and in contributing to the ultimate objective of the Convention," and to assist developed countries "in achieving compliance with their quantified emission limitation and reduction commitments."[19] The CDM provides a means for achieving those purposes by enabling developed countries (or their private entities) to fund activities in developing countries that earn them certified emissions reduction credits (CERs) for each ton of reduced greenhouse gases, which the developed countries can use to offset their domestic emissions. In other words, a developed country (or firm) earns credits for subsidizing a project in a developing country. Those projects include renewable energy development, industrial gas or methane capture, waste gas recovery, switching the fuel used in industrial processes, and forestation and reforestation.[20] The emissions reductions achieved by a project must be voluntary, real, and additional in order to earn credits under the CDM.

The CDM has succeeded in supporting a substantial number of projects. As of October 2009, there are more than 4,200 projects in the pipeline, including 1,839 that have been formally registered by the CDM Executive Board.[21] More than 60% of the projects involve energy production, another 17.6% improve waste handling and disposal, and the balance targets various industrial and agricultural

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[17] *See* United Nations Framework Convention on Climate Change [UNFCCC], Joint Implementation Supervisory Comm., *Rudaiciai Wind Power Park Project*, ITL Project ID LT2000002 (Apr. 2008), *available at* http://ji.unfccc.int/UserManagement/FileStorage/W1WQBGABVVWXBDF135LVP71PVD7RE6.

[18] *See* Patricia Nelson, *An African Dimension to the Clean Development Mechanism: Finding a Path to Sustainable Development in the Energy Sector*, 32 DENV. J. INT'L L. & POL'Y 615, 620 (2004); *see also* Albert Mumma, *The Poverty of Africa's Position at the Climate Change Convention Negotiations*, 19 UCLA J. ENVTL. L. & POL'Y 181, 189-92 (2000/2001) (describing the origins of the CDM).

[19] Kyoto Protocol, *supra* note 15, at art. 12, ¶ 2.

[20] *See* UNITED NATIONS ENV'T PROGRAMME [UNEP], YEAR END SNAPSHOT OF THE CDM 3 (Nov. 25, 2008) (providing a table listing the 25 different types of CDM projects approved in 2008), *available at* http://www.unep.org/pdf/Year-End-Snapshot-CDM.pdf.

[21] *See* UNFCCC CDM Statistics, http://cdm.unfccc.int/Statistics/index.html (last visited Oct. 12, 2009) [hereinafter CDM Statistics].

processes.[22] China is the most popular location for CDM projects. Thirty-five percent of the registered projects are there, followed by 25% in India, 9% in Brazil, and 6% in Mexico.[23] The CDM is expected to yield nearly three trillion CERs by the time the Kyoto Protocol expires in 2012.[24]

These achievements have been accompanied by numerous objections to the CDM process. Perhaps the most familiar complaint attacks the CDM as economically inefficient. Some studies show that the transaction costs involved in the CDM are greater than the abatement costs.[25] The CDM appears to subsidize at least some activities that earn more money from CER credits than from their primary products.[26] The "additionality requirement" has been the target of particular skepticism. While each project must demonstrate that the emissions reductions it achieves are "additional" to reductions that have occurred without the support from the CDM, there remains a substantial uncertainty surrounding the true emissions savings resulting from foreign investment in projects in the developing world.[27] The environmental benefits of the CDM program are questioned by its failure to result in reductions in CO_2 as opposed to other greenhouse gases,[28] and by discouraging developing countries from making the difficult decisions about how to reduce their own greenhouse gas emissions.[29] Developing countries further contend that the CDM takes advantage of them by exploiting their lack of technical experience to negotiate complex agreements, enlarging the scope of abuse by governing elites, leaving only expensive projects for the country to undertake itself in the future, and rendering countries dependent upon foreign technology.[30] For their part, the sponsors of CDM projects complain that the process of obtaining formal approval takes far too long.[31]

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[22] *See* UNFCCC, Distribution of Registered Project Activities By Scope, http://cdm.unfccc.int/Statistics/Registration/RegisteredProjByScopePieChart.html (last visited Oct. 12, 2009).

[23] *See* UNFCCC Registered Project Activities By Host Parties, http://cdm.unfccc.int/Statistics/Registration/NumOfRegisteredProjByHostPartiesPieChart.html (last visited Oct. 12, 2009) [hereinafter Registered Project Activities By Host Parties].

[24] *See* CDM Statistics, *supra* note 21.

[25] *See* Larry Karp & Xuemei Liu, *The Clean Development Mechanism and Its Controversies* 9 (Univ. of Cal., Berkeley Working Paper No. 903), *available at* http://papers.ssrn.com/sol3/Delivery.cfm/00041 7504.pdf?abstractid=223511&mirid=2.

[26] *See* Steven Ferry, *When 1+ 1 No Longer Equals 2: The New Math of "Additionality" Controlling World and U.S. Global Warming Regulation*, 10 MINN. J.L. SCI. & TECH. 591 (2009); Michael Wara, *Measuring the Clean Development Mechanism's Performance and Potential*, 55 UCLA L. REV. 1759, 1784-85 (2008).

[27] *See* Wara, *supra* note 26, at 1790-97.

[28] *See id*. at 1781-89.

[29] *See* Karp & Liu, *supra* note 25, at 12; *see also* David M. Driesen, *Free Lunch or Cheap Fix: The Emissions Trading Idea and the Climate Change Convention*, 26 B.C. ENVT'L. AFF. L. REV. 1, 13 (1998) (explaining that "developing countries need only 'address,' rather than stabilize, greenhouse gas emissions.").

[30] See Karp & Liu, *supra* note 25, at 9-13.

[31] *See, e.g.,* Andrei Marcu & Robert Dornau, *Strengthening the CDM: IETA Position Paper For Cop 11 and COP/MOP*, INT'L EMISSIONS TRADING ASS'N, Sept. 2005, at 15, 7, *available at* http://www.ieta.org/ieta/www/pages/getfile.php?docID=1132.

These complaints may doom the continuation of the CDM in the post-Kyoto international climate-change agreement. The obligations imposed by the Protocol expire by their own terms in 2012, so the international community is busily negotiating the next climate change agreement. Some critics of the CDM would like to eliminate the mechanism altogether. There is significant momentum behind the CDM process, though, so it is likely that it will continue in some form. What form that will take should be influenced not only by the general critiques noted above, but also by the particular experience of the CDM in promoting the construction of hydroelectric dams in China.

The CDM, in turn, may go far toward reconciling the conflicting positions of the United States and China. The success of the next climate change agreement is often said to depend upon the participation of both the United States and China, yet those nations disagree on many central issues.[32] The United States wants China to accept an emissions reduction requirement; China refuses. China has called for a 40% reduction below 1990 levels of greenhouse gas emissions by 2020; the American position is less than half of that.[33] The Kyoto Protocol's treatment of China was a significant factor in the unwillingness of the United States to accept the Protocol even though the U.S. played a leading role in crafting the CDM. The challenge for today's negotiators is to see if a revised CDM can join with other changes to create a new agreement that is acceptable to the United States, China, and the rest of the global community.

II. Lessons From the CDM in China

The CDM has thrived in China despite its criticisms. China accounts for more than one-third of the approved CDM projects and 46% of the credits earned by those projects.[34] As of October 2009, there were 639 registered CDM projects located in China, and another 1,500 have been approved by the Chinese government pending approval by the CDM board.[35] They included improvements to industrial facilities, methane recovery from landfills, power production from biomass, the construction of wind farms, and especially hydroelectric plants. It is

[32] The positions of the United States and China are analyzed in PEW CTR. ON GLOBAL CLIMATE CHANGE & ASIA SOC'Y, COMMON CHALLENGE, COLLABORATIVE RESPONSE: A ROADMAP ON U.S-CHINA ENERGY AND GLOBAL CLIMATE CHANGE (2009), *available at* http://www.pewclimate.org/docUploads/US-China-Roadmap-Feb09.pdf; Michael P. Vandenbergh, *Climate Change: The China Problem*, 81 S. CAL. L. REV. 905 (2008); Cass R. Sunstein, *The World vs. the United States and China? The Complex Climate Change Incentives of the Leading Greenhouse Gas Emitters*, 55 UCLA L. REV. 1675, 1682-83 (2008).

[33] *Compare* UNFCCC, Ad Hoc Working Group on Further Commitments for Annex I Parties Under the Kyoto Protocol, Report, U.N. Doc. FCCC/KP/AWG/2008/2 (May 15, 2008) (submission by China) *with* American Clean Energy and Security Act of 2009, H.R. 2454, 111th Cong. § 311 (2009) (stating economy-wide emission goals).

[34] *See* Registered Project Activities By Host Party, *supra* note 23; UNFCCC, CERs Issued By Host Party, http://cdm.unfccc.int/Statistics/Issuance/CERsIssuedByHostPartyPieChart.html (last visited Oct. 12, 2009).

[35] *See* Registered Project Activities By Host Party, *supra* note 23; *China Passes 500 Mark in U.N. Clean Energy Projects*, CHINA DAILY, Mar. 31, 2009, http://www.chinadaily.com.cn/bizchina/2009-03/31/content_7634910.htm; CLEAN DEVELOPMENT MECHANISM IN CHINA, APPROVAL STATUS OF CDM PROJECTS IN CHINA (Oct. 9, 2009), http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2350.pdf.

these hydroelectric facilities that I want to focus upon here, for the idea of using the CDM to subsidize new Chinese dams is problematic.

The premise of my proposal is that the CDM may be modified to incorporate a more nuanced approach. One environmental law precedent for that belief comes from the formula for identifying the hazardous waste sites most in need of remediation under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The 1980 statute directed the EPA to establish "[c]riteria for determining priorities among releases" of hazardous substances.[36] The agency complied by developing the Hazard Ranking System (HRS) in 1982. Under the HRS, the EPA evaluated the ability of hazardous substances to migrate into the groundwater, surface water, and the air.[37] The agency listed hundreds of sites pursuant to that formula, but it was increasingly criticized as unrealistic. Indeed, the D.C. Circuit eventually upheld EPA's listings only because of the statutory preference for a formula and despite the apparent flaws in the approach. In one case, the EPA listed a small south Florida chemical company's property on the National Priorities List (NPL) because the HRS indicated that 750,000 people in the Miami area could be affected by contaminated drinking water.[38] The HRS produced that conclusion even though the contamination apparently could not reach the deepest part of the aquifer where a solitary well drew water once a month just to prevent the well from becoming inoperable. "Our case law endorses the 'Hazard Ranking System's preference for using formulas," explained the court, "and emphasizes that 'the NPL is simply a rough list of priorities, assembled quickly and inexpensively."[39] But the court added that the EPA's decision was "troubling" because of "the very real possibility that [the] facility does not endanger the population," so it "urge[d] the EPA to move forward, quickly" to either prove the threat or to "act with dispatch to delist" the site.[40]

When Congress amended CERCLA in 1986, it directed the EPA to amend the HRS to assure that the HRS "accurately assesses the relative degree of risk to human health and the environment posed by sites and facilities subject to review."[41] The EPA rolled out a much more nuanced HRS in 1990.[42] The new HRS evaluates toxicity via carcinogenic and non-cancer chronic values instead of employing acute toxicity values, removes the ceiling on the number of people who could be exposed to a release of hazardous substances, provides a more specific examination of wetlands and of radioactive waste sites, incorporates

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[36] Comprehensive Environmental Response, Compensation and Liability Act of 1980, Pub. L. No. 96-510, § 105(8)(A), 94 Stat. 2767, (current version at 42 U.S.C. § 9605(a)(8)(A) (2002)).

[37] *See* Environmental Protection Agency, 40 C.F.R. § 300, 47 Fed. Reg. 31180, 31187 (1982).

[38] *See* B&B Tritech, Inc. v. EPA, 957 F.2d 882, 884 (D.C. Cir. 1992).

[39] *Id.* (citing Eagle-Picher Ind. v. EPA, 822 F.2d 132, 146 (D.C. Cir. 1987); Eagle-Picher Ind. v. EPA, 759 F.2d 922, 932 (D.C. Cir. 1985)).

[40] *Id.* at 885. The court noted that "[a]gency counsel conceded at oral arguments that the site would not be dangerous, indeed would not be listed, if the wellfields were only pumped once a year; that would be equivalent to zero pumping" and thus would not justify listing the site even according to the HRS. *Id.* The author was the agency counsel.

[41] *See* 42 U.S.C. § 9605(c)(1) (adding CERCLA § 105(c)(1)) (2000)).

[42] *See* Environmental Protection Agency, Hazard Ranking System, 55 Fed. Reg. 51532 (1990).

bioaccumulation into the consideration of waste characteristics, factors the quantity of hazardous wastes when characterizing those wastes, and considers actual contamination when evaluating sensitive environments.[43] That system has not eliminated all objections, but it has greatly reduced the litigation challenging NPL listings.[44]

That experience offers hope for the reform of the CDM. The ongoing discussions regarding the next climate change agreement have suggested various changes to the simple formula employed by the existing CDM. My proposal builds upon the recommendation of a UNFCCC working group to use "multiplication factors to increase or decrease the certified emission reductions issued for specific project activity types."[45] To illustrate, a multiplication factor could be employed so that favored technologies such as wind farms earn 1.25 credits for every one ton of greenhouse gas emissions that they avoid, while a less favored technology such as clean coal projects earns only .75 credits for every ton of avoided greenhouse gas emissions. The idea of discounting emissions credits can be traced to the Clean Air Act in the United States, and several writers have articulated different versions of possible discounting schemes for the CDM.[46] The difficult question is which criteria should support multiplied credits and which criteria should support discounted credits. China's experience with the use of CDM funding to build hydroelectric dams begins to answer that question.

A. China

The CDM subsidizes many projects in China. The rationale for such subsidies is that the Chinese economy has been developing rapidly, so it is wise to direct China's development away from things that contribute to climate change. The problem with that approach is two fold. First, China's economic development has produced vast financial resources of its own to invest in such environmentally-friendly efforts. Second, the funds invested – and the CDM credits earned – in China are not directed to other countries who are in much greater need of development assistance.

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[43] *See id.* at 51533.

[44] The last NPL listing to be challenged in court occurred in 2005. *See* Carus Chem. Co. v. U.S. Envtl. Prot. Agency, 395 F.3d 434 (D.C. Cir. 2005). The most recent controversy surrounds the Gowanus Canal in Brooklyn, where the EPA's proposal to list it on the NPL (*see* Environmental Protection Agency, National Priorities List, Proposed Rule No. 50, 74 Fed. Reg. 16162, 16167 (2009)) has elicited the opposition of local residents and New York City officials. *See* Mireya Navarro, *On the Gowanus Canal, Fear of Superfund Stigma*, N.Y. TIMES, Apr. 23, 2009, http://www.nytimes.com/2009/04/24/science/earth/24gowanus.html?hp.

[45] UNFCCC, Ad Hoc Working Group on Further Commitments for Annex I Parties Under the Kyoto Protocol, *Emissions Trading and the Project-Based Mechanisms*, p.11, U.N. Doc FCCC/KP/AWG/2008/L.12 (Aug. 27, 2008), *available at* http://unfccc.int/resource/docs/2009/awg7/eng/l02.pdf; *see also* STEFAN BAKKER & RAOUF SAIDI, MARKET IMPACTS OF CDM DIFFERENTIATION (2008), http://www.ecn.nl/fileadmin/ecn/units/bs/CDM/Stefan_Bakker_ECN_Market_impacts_CDMdiff.pdf (presentation supporting the use of multiplication factors).

[46] *See* Andrew Schatz, *Discounting the Clean Development Mechanism*, 20 GEO. INT'L ENVTL. L. REV. 703, 727-28 (2008) (citing the CAA example and proposing to revise the CDM to discount "the value of each [greenhouse gas] credits to more closely reflect the marginal cost of abatement for each pollutant").

The dilemma can be illustrated by the two faces of China. Like *developing* countries, China is poor. Its per capita income remains in the bottom half of the world.[47] Of the 1.37 billion people in the world who live on less than $1.25 per day, 208 million live in China. Much of China's population lives as if it is a developing country. This is true both in the countryside, where the rural peasants often live in the same way that their ancestors did generations ago; and in the cities, where the unprecedented migration of people from the countryside to the cities in search of better economic opportunities has overwhelmed the ability of the cities to provide for them. China relies upon such evidence when it describes itself as "a low-income developing country."[48]

But like *developed* countries, China has one of the leading economies in the world. It is the world's leading producer of steel, producing four times as much as the United States.[49] It produces nearly three times as much coal as the United States.[50] It produces half of the world's cement and manufactures 28% of the world's aluminum.[51] It had the fourth largest gross domestic product in the world in 2007, just behind Japan. It imports more oil than every country except the United States and Japan.[52] These and other statistics are frequently cited in the many popular books reporting on China's ascension to economic powerhouse.[53]

So which is it? Is China a developing country or a developed country? The answer, of course, is both – or neither. Yet the Kyoto Protocol insists that every country must be categorized as one or the other. The Protocol assigned China to the developing country list of Annex II, thus exempting it from the greenhouse gas emission reductions imposed upon developed countries and pushing the United States toward its refusal to approve the Protocol and its eventual renunciation of it.

The effect of the Kyoto Protocol has been to treat China differently from most other developing countries. China is excluded from the emissions regulations applicable to developed countries, but China has benefited from much more CDM investment than most developing countries. China accounts for 33% of the

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[47] *See* THE WORLD BANK, POVERTY DATA: A SUPPLEMENT TO WORLD DEVELOPMENT INDICATORS 2008 11 (2008), *available at* http://siteresources.worldbank.org/DATASTATISTICS/Resources/WDI08supplement1216.pdf.

[48] THE PEOPLE'S REPUBLIC OF CHINA, INITIAL NATIONAL COMMUNICATION ON CLIMATE CHANGE: EXECUTIVE SUMMARY 1 (2004), http://www.ccchina.gov.cn/file/en_source/da/da2004110901.pdf.

[49] *See* ALLIANCE FOR AMERICAN MANUFACTURING, AN ASSESSMENT OF ENVIRONMENTAL REGULATION OF THE STEEL INDUSTRY IN CHINA 3 (2009), http://chinaenvironmental-report-march-2009.pdf.

[50] *See* INT'L ENERGY AGENCY, KEY WORLD STATISTICS: 2008 15 (2008), www.iea.org/Textbase/nppdf/free/2008/Key_Stats_2008.pdf.

[51] *See* PEW CTR. ON GLOBAL CLIMATE CHANGE & ASIA SOC'Y, *supra* note 32, at 18.

[52] ENERGY INFORMATION ADMINISTRATION [EIA], COUNTRY ANALYSIS BRIEFS: CHINA 2 (2009*), available at* http://www.eia.doe.gov/emeu/cabs/China/pdf.pdf.

[53] *See*, e.g., ROB GIFFORD, A JOURNEY INTO THE FUTURE OF A RISING POWER (Random House 2008); JAMES KYNGE, CHINA SHAKES THE WORLD: A TITAN'S RISE AND TROUBLED FUTURE – AND THE CHALLENGE FOR AMERICA (Mariner Books 2007); TED C. FISHMAN, CHINA, INC.: HOW THE RISE OF THE NEXT SUPERPOWER CHALLENGES AMERICA AND THE WORLD (Scribner 2006); ODED SHENKAR, THE CHINESE CENTURY: THE RISING CHINESE ECONOMY AND ITS IMPACT ON THE GLOBAL ECONOMY, THE BALANCE OF POWER, AND YOUR JOB (Wharton School Publishing 2006).

CDM projects, and China and India together account for 59% of the CDM projects.[54] By contrast, dozens of developing countries have together received only 18% of the CDM projects. The CDM has largely ignored Africa, which produces a minimal amount of the world's greenhouse gas emissions but which has attracted an equally minimal amount of CDM investment. Africa has received only 2% of the projects registered under the CDM; excluding Egypt and South Africa, the rest of Africa has received less than 1%.[55] African nations had proposed that "projects should be allocated on an equitable regional/subregional basis" when the CDM was being designed, but that did not happen.[56] The investors who sought to capitalize on the CDM saw many more opportunities in China, India, and other rapidly developing countries than they did in the least developed countries of Africa and Asia. The difficulty lies in the CDM's reliance upon emissions reductions. Renewable energy projects can easily reduce emissions in China when the alternative is the generation of energy by burning coal, but there are few such large projects whose emissions need to be reduced in Africa.

But the CDM is about more than reducing greenhouse gas emissions. One of the purposes of the CDM is "achieving sustainable development."[57] Numerous international environmental treaties, including the 1992 Rio Declaration on Environment and Development, embrace the idea of sustainable development. The Rio Declaration recites that the human right to economic development "must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations" in order that all people enjoy "a healthy and productive life in harmony with nature."[58] The African understanding of the CDM would have afforded "equal importance" to sustainable development and emissions reductions.[59] Instead, numerous studies have faulted the CDM for failing to achieve, or even consider, its goal of promoting sustainable development where it is needed most.[60] Sustainable development has yet to occur in most of

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[54] *See* CLEAN DEVELOPMENT MECHANISM IN CHINA, *supra* note 35.

[55] *See* UNEP, *supra* note 20, at 8.

[56] Conference of the Parties to the Framework Convention on Climate Change, Nov. 2-13, 1998, *Matters Related to the Kyoto Protocol: Matters Related to Decision 1/CP.3 Paragraph 5*, ¶2 (d), U.N. Doc. FCCC/CP/1998/MISC.7/Add.2 (Nov. 5, 1998), *available at* http://unfccc.int/resource/docs/cop4/misc07a02.pdf. [hereinafter African CDM Submission]. Africa's role in the CDM is well summarized in Nelson, *supra* note 18; and Mumma, *supra* note 18.

[57] Kyoto Protocol, *supra* note 15, art. 12(2).

[58] United Nations Conference on Environment and Development [UNCED], June 3-14, 1992, *Rio Declaration on Environment and Development*, princs. 3, 1, U.N. Doc. A/CONF.151/26 (vol. I) (June 13, 1992). Note that the precise meaning of sustainable development is unclear, but its specific meaning is not necessarily pertinent in this context.

[59] African CDM Submission, *supra* note 56, ¶ 2(j).

[60] *See, e.g.,* Stefan Bakker et al., *Differentiation in the CDM: Options and Impacts*, SCI. ASSESSMENT & POL'Y ANALYSIS PROGRAMME FOR CLIMATE CHANGE, June 8, 2009, at 20, *available at* http://www.mnp.nl/bibliotheek/rapporten/500102023.pdf; Lambert Schneider, *Options to Enhance and Improve the Clean Development Mechanism (CDM)* 27-31 (ETC/ACC Tech. Paper 2008/15, 2008), *available at* http://air-climate.eionet.europa.eu/docs//ETCACC_TP_2008_15_future_CDM.pdf; Katrina Brown, W. Neil Adger, Emily Boyd, Esteve Corbera-Elizalde & Simon Shackley, *How Do CDM Projects Contribute to Sustainable Development?*, TYNDALL CENTRE FOR CLIMATE CHANGE RESEARCH, June 2004, *available at* http://tyndall.uea.ac.uk/sites/default/files/it1_13.pdf; Haripriya Gundimeda, *How "Sustainable" is the*

Africa, as "little progress was made in reducing extreme poverty in sub-Saharan Africa" despite the commitments contained in the Millennium Development Goals of 2000.[61] The Johannesburg Plan of Implementation of sustainable development in Africa calls for increased technology development and transfer, financial and technical support in crafting environmental law and policy, and the promotion of numerous initiatives designed to address Africa's chronic energy problems.[62] Focusing the CDM on the poorest countries of Africa could further each of these approaches. Commentators as diverse as Nicholas Stern and the International Emissions Trading Association have called for the poorest counties of the world to receive a greater share of CDM investment.[63] There are some signs that this is beginning to occur,[64] but the pace is very slow compared to the overall growth of the CDM.

The CDM could improve its ability to encourage sustainable development in Africa and in other least developed countries by adjusting the amount of credits that projects receive depending upon the country in which they are located.[65] The idea is to provide additional credits for projects located in countries that have yet to experience significant economic development while providing somewhat fewer credits for projects located in rapidly developing countries (such as China). The Human Development Index (HDI) developed by the United Nations offers

"Sustinable Development Objective" of CDM in Developing Countries Like India?, 6 FOREST POL'Y & ECON. 329 (2004); Youba Sokona, Adil Najam & Saleemul Huz, *Climate Change and Sustainable Development: Views from the South*, INT'L INST. ENV'T & DEV. (2002), *available at* http://www.wssd-and-civil-society.org/docs/iied_04.pdf.

61 U.N. DEPT. OF ECON. & SOC. AFFAIRS [DESA], THE MILLENNIUM DEVELOPMENT GOALS REPORT AUGUST 6 (2008), http://www.un.org/millenniumgoals/2008highlevel/pdf/newsroom/mdg%20reports/MDG_Report_2008_ENGLISH.pdf. A recent report attributes Africa's lack of progress toward the Millennium Development Goals to "poorly developed infrastructure, lack of institutional capacity, and continuing needs for investment in agriculture." U.N. COMM'N ON SUSTAINABLE DEV., POLICY OPTIONS AND PRACTICAL MEASURES TO EXPEDITE IMPLEMENTATION IN AGRICULTURE, RURAL DEVELOPMENT, LAND, DROUGHT, DESERTIFICATION AND AFRICA 37 (2009), http://www.un.org/esa/dsd/resources/res_pdfs/csd-17/Final_text.pdf.

62 *See* DESA, JOHANNESBURG PLAN OF IMPLEMENTATION OF THE WORLD SUMMIT ON SUSTAINABLE DEVELOPMENT 35-36 (2005), http://www.un.org/esa/sustdev/documents/WSSD_POI_PD/English/WSSD_PlanImpl.pdf.

63 *See* Cameron Hepburn & Nicholas Stern, *A New Global Deal on Climate Change*, 24 OXFORD REV. ECON. POL'Y 259, 273 (2008) (noting that the CDM "is contributing very little to sustainable development in the poorest countries, which was one of the original objectives of the mechanism"); Marcu & Dornau, *supra* note 31, at 17 (encouraging "a better geographical spread to least developed and other poor developing countries").

64 *See* UNEP, *supra* note 20, at 14-15, (citing the CDM's support of a hydroelectric dam in Mali, an onion preservation project in Niger, a waste composting project in Ghana, and the "clean, hydro based electrification of rural areas in Zambia").

65 For similar proposals, see Bakker et al., *supra* note 60, at 41-42 (May 2009) (describing ways of differentiating between parties that host CDM projects); Schatz, *supra* note 46, at 735 (recommending the use of higher discount rates for larger developing economies); AXEL MICHAELOWA, DISCOUNTING OF CERS TO AVOID CER IMPORT CAPS 1 (2008), http://www.bvek.de/downloads/Discounting%20of%20CERs-cop12-08%20bvek.pdf (proposing "[a] discount factor that increases with the level of development of a country" as measured by a new development index); Schneider, *supra* note 60, at 33-34 (suggesting that credits from more advanced developing countries should be discounted in order to encourage projects in the least developed countries); Kyle Meng, *Creating a Cleaner CDM*, CARBON FINANCE, Sept. 2007, at 16, *available at* http://www.edf.org/documents/7271_CFSept%202007_ED_CDM.pdf (proposing a sliding scale in credits that would give more weight to projects in the least developed countries).

one formula that could accomplish that result. The HDI is designed to calculate human well-being throughout the world as evidenced by life expectancy, literacy, and relative purchasing power.[66] The United Nations Development Program updates and publishes the HDI for 170 countries annually.[67] Generally, the highest-ranking 40 countries appear on the Kyoto Protocol's Annex I list of developed countries. The remaining 139 countries are considered developing countries on Annex II. An easy multiplication factor could be gleaned from each developing country's HDI ranking. For example, Brazil is ranked 75th in the 2007 HDI, so any CDM projects located there would generate .75 emissions credits for each ton of greenhouse gas emissions.[68] Chad, by contrast, would multiply each ton of reduced emissions by 1.75 because Chad is ranked 175th on the HDI list.[69] China is ranked 92nd, so any future CDM projects that are built in China would qualify for .92 credits per ton of reduced emissions.[70] The resulting multiplication factor would still commit CDM funding to projects in China, but it would make CDM investment even more attractive in less developed countries that have yet to receive many of the benefits of the CDM.

B. Dams

The second objection to the CDM's subsidy of dams in China focuses upon the environmental and social consequences of those dams. China has a long history of actively managing its water, but there were only 22 large dams in the country when the Communist Party established the People's Republic of China in 1949.[71] China then went on a building spree that produced 85,000 significant reservoirs and dams – including 22,000 large dams – by 2000.[72] Most of those dams were built for flood control or for irrigation, though they often generated hydroelectric power as well. Since 2000, China has pushed to increase the amount of electricity that it generates through hydropower. By 2009, China

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[66] *See* U.N. DEV. PROGRAM, HUMAN DEVELOPMENT REPORT 2009: OVERCOMING BARRIERS: HUMAN MOBILITY AND DEVELOPMENT (2009), http://hdr.undp.org/en/media/HDR_2009_EN_Summary.pdf [hereinafter UNDP, HUMAN DEVELOPMENT REPORT 2009]. The HDI

> [M]easures the average achievements in a country in three basic dimensions: a long and healthy life as measured by life expectancy at birth; access to knowledge, as measured by the adult literacy rate and the combined gross enrolment ratio in education; and a decent standard of living, as measured by GDP per capita in purchasing power parity (PPP) US dollars.

UNDP, HUMAN DEVELOPMENT REPORT, *supra* note 66, at 11.

[67] *See* UNDP, Statistics of the Human Development Report, http://hdr.undp.org/en/statistics/ (last visited Oct. 13, 2009) [hereinafter UNDP, Statistics]. Dr. Mumma first suggested the use of the HDI as a tool for achieving equitable responsibility for climate change, but his proposal focused on the permissible amount of greenhouse gas emissions rather than targeting CDM investment. *See* Mumma, *supra* note 18, at 204-06.

[68] UNDP, Statistics, *supra* note 67.

[69] *Id.*

[70] *Id.*

[71] *See generally* R. Fuggle & W.T. Smith, *Experience with Dams in Water and Energy Resource Development in the People's Republic of China* 6-8 (Working Paper Prepared for the World Commission on Dams, 2000) (report describes the history of dams in China).

[72] *See id.* at 1.

produced more electricity from hydropower than any other country and China plans to double its hydropower capacity by 2020.[73]

The head of the World Commission on Dams observed that "[o]ne need not think too far back to recall the days when large dam projects were a matter of significant national pride."[74] Yet dams pose a dilemma. On the one hand, as the World Commission on Dams found, "Dams have made an important and significant contribution to human development, and the benefits derived from them have been considerable."[75] But, the Commission added, "in too many cases an unacceptable and often unnecessary price has been paid to secure those benefits, especially in social and environmental terms, by people displaced, by communities downstream, by taxpayers, and by the natural environment."[76] China's recent dam construction boom illustrates both sides of the debate over dams.

The Three Gorges Dam is the leading international symbol of China's new dams. First proposed by Sun Yat-Sen in 1919, Three Gorges is now the largest dam in the world.[77] Its primary purpose is to alleviate the flooding that killed thousands of Chinese residents throughout the centuries, but the dam also generates more hydroelectric power than any other dam in the world. Yet the dam was criticized for its environmental impacts, especially its threat to the rare (and now extinct) Yangtze River Dolphin and to biodiversity more generally; its cultural impacts, including the flooding of dozens of archaeological sites and ancient monuments; and its social impacts upon the more than one million people who had to be resettled to avoid the rising waters of the new reservoir once the dam was closed.[78]

The Three Gorges Dam did not receive any support from the CDM, but hundreds of other Chinese dams have sought approval under the CDM. The Xiaogushan hydropower plant was the first such dam, built in western China's Gansu province in 2003 for the purpose of "easing power-supply shortages, pro-

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[73] *See* INT'L ENERGY AGENCY, *supra* note 50, at 19; Tao Wang & Jim Watson, *China's Energy Transition: Pathways for Low Carbon Development*, TYNDALL CENTRE FOR CLIMATE CHANGE RESEARCH, 2009, at 16, *available at* http://www.sussex.ac.uk/sussexenergygroup/documents/china_report_forweb.pdf.

[74] Kader Asmal, *Introduction: World Commission on Dams Report, Dams and Development*, 16 AM. U. INT'L L. REV. 1411, 1417 (2001). The World Commission on Dams evolved from the desire of the World Bank and IUCN to evaluate large dam projects in the developing world. *See id*. at 1421-23. The WCD issued its report in 2000. *See* WORLD COMM'N ON DAMS, DAMS AND DEVELOPMENT: A NEW FRAMEWORK FOR DECISION MAKING (Earthscan Publications Ltd. 2000), *available at* http://www.dams.org/report/contents.htm; *see also The Report of the World Commission on Dams*, 16 AM. U. INT'L L. REV. 1435 (2001) [hereinafter *The Report*] (reprinting the report's executive summary).

[75] *The Report*, *supra* note 74, at 1436.

[76] *Id*.

[77] *See* Fuggle & Smith, *supra* note 71, at 12-14 (table that provides a chronology of events related to the Three Gorges Dam).

[78] *See id*. at 9-11 (summarizing the environmental, cultural, and social concerns about the dam); *see also* SAMUEL TURVEY, WITNESS TO EXTINCTION: HOW WE FAILED TO SAVE THE YANGTZE RIVER DOLPHIN 27-28, 37 (Oxford University Press 2008) (describing the role that the Three Gorges and other dams played in the apparent extinction of the dolphin).

tecting the environment, and removing poverty in local regions."[79] By September 2009, 904 Chinese dams received or sought approval from the CDM.[80] That has provoked the ire of a number of environmental organizations, especially International Rivers, which has been particularly outspoken about the environmental effects of the new Chinese dams funded by the CDM. It cites the example of the Xiaoxi Dam in Hunan Province, the home of Mao Zedong in central China. International Rivers reports, "this large dam epitomizes the abuse of carbon offsets and the many flaws in the CDM. In this case, the dam has evicted from their homes poor farmers in Hunan Province, China, while allowing Germany to burn more coal and still meet its Kyoto commitments."[81] International Rivers further complains:

> The German power utility RWE, one of the biggest CO_2 emitters in Europe, intends to buy CDM credits from the dam so that it can continue to expand its coal-fired electricity generation. In addition to generating offsets that don't lead to any real emissions reductions (because the dam has been built regardless of whether it receives CDM approval), Xiaoxi is beset with resettlement abuses, and fails to meet the basic standards of the World Commission on Dams as required by European law.[82]

International Rivers has submitted formal objections to other Chinese hydroelectric dams seeking CDM approval as well.[83]

Moreover, the most controversial dams may be yet to come. In 2003, the United Nations designated the Three Parallel Rivers of Yunnan as a World Heritage site. The three rivers – the Nu, the Mekong, and the Yangtze – flow south from the Himalayas through a remote area that is home to one of the world's leading biodiversity hotspots.[84] According to the International Union for Conservation of Nature (IUCN), "[t]he area is the most outstanding region for animal diversity in China, and likely in the Northern Hemisphere."[85] China established

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[79] The World Bank, *Clean Development Mechanism in China: Taking a Proactive and Sustainable Approach* xxv (The World Bank, Working Paper No. 30245, 2004), *available at* http://www.worldbank.org.cn/english/content/cdm-china.pdf.

[80] *See* Int'l Rivers, Spreadsheet of Hydro Projects in the CDM Project Pipeline (2009), http://www.internationalrivers.org/files/CDM%20Hydro%20Spreadsheet%20Oct06.xls. As of October 6, 2009, China has a total of 910 projects. *Id.*

[81] *Xiaoxi Dam, China*, Int'l Rivers, http://internationalrivers.org/en/china/china-other-projects/xiaoxi-dam-china.

[82] *Id.*

[83] *See* Letter from Barbara Haya, Consultant, Int'l Rivers, to Sven Kolmetz, Tüv Süd Industrie Service GmbH (July 11, 2007), *available at* http://internationalrivers.org/en/global-warming/carbon-trading-cdm/comments-jinjitan-large; Patrick McCully, *Comments on World Bank PCF Xiaogushan Large Hydro Project (China)*, Int'l Rivers, Aug. 21, 2005, http://internationalrivers.org/node/1340; *see generally* Letter from Barbara Haya, Consultant, Int'l Rivers, to Hans Jürgen Stehr, Chair CDM Executive Board, CDM Secretariat (Oct. 12, 2007), *available at* http://www.internationalrivers.org/node/1892 (expressing "serious concern about the hundreds of hydropower projects from China currently entering and progressing through the CDM pipeline").

[84] *See* U.N. Educ. Scientific & Cultural Org., World Heritage Nomination – IUCN Technical Evaluation: Three Parallel Rivers of Yunnan Protected Areas (China) ID No 1083, at 2 (2003), *available at* http://whc.unesco.org/archive/advisory_body_evaluation/1083.pdf.

[85] *Id.* at 3.

its first national park there in 2007.[86] The area is also home to large numbers of ethnic minorities. Yet China has proposed to build a dozen hydroelectric dams on the Nu River alone.[87] Much of the electricity to be generated by the dams would be sent to the more populous and economically developed cities in eastern China. Opponents cite the resulting loss of biodiversity and the displacement of tens of thousands of people for their ancestral lands.[88] Supporters see the dam as "the only exit we have" from generations of poverty.[89] The controversy caused Chinese Premier Win Jiabao to stop the project in 2004 pending further environmental studies, and in 2005 a coalition of Chinese NGOs and individuals called for those studies to be released before a decision about the dams is made.[90] "Damming the Nu has become a national debate in China," explained one activist, but there are indications that the project will resume soon.[91]

The appeal of hydroelectric dams is curious given that dams have long been a target of environmental complaints in the United States. John Muir failed in his lengthy fight to prevent the damming of the Hetch Hetchy Valley near Yosemite, but the dispute resulted in the creation of the Sierra Club and provided the first illustration of organized opposition to the environmental effects of a proposed project.[92] Another unsuccessful fight targeted the Tellico Dam in eastern Tennessee, which Congress specifically authorized after the Supreme Court held that the new Endangered Species Act (ESA) mandated that the dam must give way to the endangered snail darter.[93] Dams have become a routine target of environmental litigation relying upon the ESA, that fish preservation requirements were built into Federal Energy Regulatory Commission (FERC) relicensing decisions and other regulations. It is widely accepted that the era of large dam construction in the United States is over.

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[86] *See China: Places We Protect: China's First National Park*, THE NATURE CONSERVATORY, http://www.nature.org/wherewework/asiapacific/china/work/pudacuo.html.

[87] See Mark Jenkins, *Searching for Shangri-La: Two Visions of the Future Compete for the Soul of China's Western Frontier*, NAT'L GEOGRAPHIC, May 2009, at 69, for a map of the area and the proposed dams. A map of dam projects in the greater Shangri-la region is also available at http://www.internationalrivers.org/en/china/map-dam-projects-greater-shangri-la-region.

[88] *See* Philip H. Brown, Darrin Magee & Yilin Xu, *Socioeconomic Vulnerability in China's Hydropower Development*, 19 CHINA ECON. REV. 614 (2008).

[89] Wu Ming Xiaojie, *Report from China's Nu River Valley: Building Dams to Get Rich is Glorious, China Rivers Project*, WORLD RIVERS REV., Oct. 2006, *available at* http://chinariversproject.org/?q=node/30.

[90] *See Chinese Groups Demand Disclosure of Environmental Studies,* INT'L RIVERS, Aug. 31, 2005, http://internationalrivers.org/node/1059 (reprinting the letter sent by the Chinese NGOs and individuals and describing Wen's decision).

[91] Jenkins, *supra* note 87 (quoting Yu Xiaogan, the founder of Green Watershed). *See* Shi Jiangtao, *Rumours of Dam-building Leave Villagers Fearing for Their Future*, S. CHINA MORNING POST, Feb. 25, 2008, at 6.

[92] *See generally* ROBERT W. RIGHTER, THE BATTLE OVER HETCH HETCHY: AMERICA'S MOST CONTROVERSIAL DAM AND THE BIRTH OF MODERN ENVIRONMENTALISM (Oxford University Press 2005) (reconstructing the political battles that accompanied San Francisco's struggle to secure a source of Sierra Nevada water – from 1882 to 1934).

[93] *See* Tenn. Valley Auth. v. Hill, 437 U.S. 153 (1978).

We are even tearing down dams in the U.S. because of their environmental impacts. Consider the Fort Halifax Dam, built along Maine's Sebasticook River in 1908. The primary purpose of the dam was to generate electricity for Maine's industries. By the end of the twentieth century, though, those industries had disappeared and there was a growing interest in preserving the river's native shad and other fish. During its FERC relicensing proceedings, the dam's owner agreed to either install a fish pump or remove the dam. The owner opted for the fish pump and then switched to dam removal because the pump would have been prohibitively expensive. That decision spawned litigation between the proponents of the dam's removal (including federal and state environmental agencies and private environmental organizations) and the city and others who wanted to keep the dam for its historic, recreational, and other benefits. The courts sustained the owner's plan to remove the dam.[94] In 2008, another hydroelectric developer sought to take over the project, citing the public interest in "retention of a clean, renewable energy source," but FERC held that it was "incredibly late" in the process for "a possibly quixotic attempt" to save and operate the dam.[95] Finally, in the summer of 2008, the Fort Halifax Dam was destroyed exactly one century after its construction. The area's ecology will improve, but electric power must be obtained from elsewhere.

Or consider the Savage Rapids Dam, one of four major dams along the Rogue River in Oregon. Savage Rapids was built in the 1930's for irrigation purposes, but almost immediately it began killing lots of salmon. By 2001, the salmon were endangered and the dam was subjected to scrutiny under the Endangered Species Act.[96] Congress got involved and appropriated $36 million for diversion pumps to replace the diversion that the dam had accomplished by water pressure.[97] The dam was removed in April 2009.[98] Ironically, the dam did not generate any electricity, but the pumps now rely upon electricity that must be generated elsewhere.

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[94] *See* Save Our Sebasticook v. FERC, 431 F.3d 379 (D.C. Cir. 2005). Another FERC decision to allow the removal of a hydroelectric dam in North Carolina is now pending before the D.C. Circuit. *See* Brief of Petitioners, Jackson County, N.C. v. FERC, No. 08-1224 (D.C. Cir, June 20, 2008) (seeking review of Duke Energy Carolinas, LLC, 120 F.E.R.C. ¶ 61,054 (July 19, 2007), and Duke Energy Carolinas, LLC, 123 F.E.R.C. ¶ 61,069 (Apr. 22, 2008) (order on reh'g). *See also* David H. Becker, *The Challenges of Dam Removal: The History and Lessons of the Condit Dam and Potential Threats from the 2005 Federal Power Act Amendments*, 36 LEWIS & CLARK ENVTL. L. REV. 811 (2006) (examining the obstacles that remain before the Condit Dam may finally be removed and the potential effects of the 2005 amendments to the FPA on efforts to provide fish passage and remove dams).

[95] Order Rejecting Requests For Stay and Motion to Amend Surrender Order, FPL Energy Maine Hydro, LLC, 124 F.E.R.C. ¶ 61,037, 6-7 (July 17, 2008).

[96] *See* Memorandum from Donna Darm, Acting Reg'l Adm'r, on Endangered Species Act Section 7 Formal Consultation, Section 10 Findings, and Magnuson-Stevens Act Essential Fish Habitat Consultation, Savage Rapids Dam, Irrigation Operation for 2001, Jackson and Josephine Counties, Or. (May 4, 2001).

[97] *See* Energy and Water Development Appropriations Act of 2004, Pub. L. No. 108-137, § 220, 117 Stat. 1827, 1853.

[98] *See* Patrick Reis, *Salmon: String of Victories Against Ore. Dams Leaves Anglers, Enviros Optimistic*, LAND LETTER, Apr. 9, 2009.

The irrigation pumps along the Rogue River are a reminder that electricity demand continues to climb in the United States. Hydroelectric dams provide a modest role in meeting that demand, accounting for only 3% of the electricity generated in the U.S. in 2007.[99] One recent study of American dam building concluded that "as the American economy expanded into the 1960s and 1970s, the relative importance of federal hydroelectric power facilities diminished" as "there came a point at which additional hydropower capacity gradually proved more difficult (and eventually impossible) to build."[100] Yet the study also concluded, "even as the importance of hydroelectric power seems to shrink in the face of other energy sources, it in fact holds ever-increasing value as the demand for power grows into the twenty-first century."[101]

Besides their ecological impacts, dams may also result in social disruption when local residents are displaced to accommodate a new project. International Rivers places Brazilian and Kenyan dams in its Hydro Hall of Shame because of their impact on native communities.[102] The disruption has been even more acute in China. One study concluded, "the resettlement programs of all major water projects undertaken in China from the late 1950s to the late 1970s failed disastrously."[103] The situation improved by the time the Three Gorges Dam was built at the beginning of the twenty-first century, but the sheer size of the project – it displaced about 1.5 million people living in 13 major cities, 140 towns, and 1,300 villages – created massive social disruption.[104] Studies of the impacts of that dam concluded that women suffered disproportionately. China has taken steps to minimize those effects,[105] but the problems still exist. The Associated Press reported in January 2009 that the 7,500 people who were displaced by the new Xiaoxi dam were less than the modest sums that Chinese law requires but they "still seethe over losing their homes and farmland."[106]

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[99] *See* ENERGY INFO. ADMIN., ANNUAL ENERGY REVIEW 2008 7 (2009), *available at* http://www.eia.doe.gov/emeu/aer/pdf/pages/sec1_7.pdf. Hydropower's share of electricity generation in the United States peaked at 5.5% in 1983. *See id.*

[100] DAVID P. BILLINGTON & DONALD C. JACKSON, BIG DAMS OF THE NEW DEAL ERA: A CONFLUENCE OF ENGINEERING AND POLITICS 297 (University of Oklahoma Press 2006).

[101] *Id*. at 298.

[102] *See* Barbara Haya, *The CDM's Hydro Hall of Shame, 2008: "Dams, Rivers and People" Report*, INT'L RIVERS, 2008, http://www.internationalrivers.org/en/node/2837.

[103] Jun Jing, *Displacement, Resettlement, Reparation and Development – China Report* 3 (Working Paper Prepared for the World Commission on Dams), *available at* http://www.dams.org/docs/kbase/contrib/soc203.pdf.

[104] *See* JAN KNIPPERS BLACK, THE POLITICS OF HUMAN RIGHTS PROTECTION: MOVING INTERVENTION UPSTREAM WITH IMPACT ASSESSMENT 148 (Rowman & Littlefield Publishers, Inc. 2008) (enumerating the number of people displaced by the dam); *see also* Sarah C. Aird, *China's Three Gorges: The Impact of Dam Construction on Emerging Human Rights*, 8 HUM. RTS. BRIEF 24, 25 (2001) (contending that "[w]omen . . . suffer disproportionately due to the construction of large dams").

[105] *See* Jing, *supra* note 103 (discussing the evolution of China's resettlement efforts); Fuggle & Smith, *supra* note 71, at 18-26 (finding that the resettlement of 67,000 residents due to the construction of the Shuikou Dam in Fujian Province was successful).

[106] Joe McDonald & Charles J. Hanley, *China Dams Reveal Flaw in Warming Tool*, THE ASSOCIATED PRESS, Jan. 27, 2009, http://www.msnbc.msn.com/id/28777386.

Of course, hydroelectric dams have positive values as well. For the CDM, it suffices that hydroelectric power does not emit any greenhouse gases. The collateral benefits of using the CDM to build dams in China include the reduction of traditional air pollutants and the improved standard of living that such facilities offer to those living in very poor communities. China is also working to minimize the environmental and social consequences of its new dams. As one Chinese official working for the Nature Conservancy observed, "Dams are a reality in China. We don't like them from a biodiversity standpoint, but we . . . can work with agencies in China and international experts to help find solutions."[107] Those solutions include using hydropower revenue to fund conservation programs, improving flood management, and releasing water at times and in quantities that help the native fish.

Dams are thus a necessary evil from the perspective of China's economy, society, and environment. They are evil in the eyes of defenders of biodiversity. They are necessary as an alternative to China's use of massive amounts of coal with the attendant consequences for climate change, traditional air pollution, and other environmental ills. The challenge, then, is to identify the appropriate legal mechanism to guide China's energy development in a manner that has the least impact upon China's – and the world's – environment.

As applied by most host countries, the CDM adopts a polar view of the environment: anything that releases carbon is bad, while anything that prevents carbon emissions is good. The CDM is supposed to embrace sustainable development, but one report observed that "[t]he Kyoto Protocol embodies something of an unwritten assumption, namely that projects that are good for carbon abatement must also be good for sustainable development."[108] That assumption is flawed because not every method of reducing greenhouse gas emissions contributes to sustainable development, and some methods of reducing emissions offer much greater contributions to sustainable development than others. The CDM, however, takes an all-or-nothing approach. The CDM promotes renewable sources of energy such as wind and solar power even though they confront various environmental complaints.[109] At the same time, the CDM awards equal credits to projects that prevent greenhouse gas emissions but whose overall environmental impacts are more questionable, such as reducing the amount of nitrous acid burned in nitric acid plants and reducing methane emissions from charcoal

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[107] Misty Herin, *China - Minimizing Dam Impact on the Yangtze River*, THE NATURE CONSERVATORY, 2009, http://www.nature.org/wherewework/asiapacific/china/features/yangtzedams.html.

[108] Duncan Austin & Paul Faeth, *How Much Sustainable Development Can We Expect From the Clean Development Mechanism?*, WORLD RESOURCES INST., Nov. 1999, at 2, *available at* http://pdf.wri.org/cdm-note.pdf.

[109] *See, e.g.*, Residents Opposed to Kittitas Turbines v. State Energy Facility Site Evaluation Council, 197 P.3d 1153 (Wash. 2008) (holding that the state governor could override a county's aesthetic concerns to allow the sitting of a wind farm); Jim Abbott, Acting Cal. State Director, Bureau of Mgmt., Statement on Solar Energy Development on Federal Lands: The Road to Consensus: Oversight Field Hearing of the Subcomm. on Energy & Mineral Resources of the House Natural Resources Comm. 4 (May 11, 2009), *available at* http://www.blm.gov/pgdata/etc/medialib/blm/wo/Communications_Directorate/2009_congressional.Par.43610.File.dat/Field%20Hearing,%20Solar%20Energy%20Development%20on%20Federal%20Lands,%20HNR,%20E%20&%20MR%20(5-11-09.pdf (describing the effects of solar energy projects on fragile desert biodiversity and upon scare water resources).

projection.[110] Worse still, the CDM's focus on greenhouse gases results in it crediting projects that will reduce "super-pollutants" based upon the fact that the greenhouse effect of such pollutants is as much as 23,900 times greater than carbon dioxide.[111] Yet other projects that prevent the emission of greenhouse gases are excluded from the CDM. Nuclear power does not release any greenhouse gases, yet the CDM excludes the development of nuclear power facilities from eligibility for CDM funding.[112] Carbon capture and sequestration (CCS) has yet to be approved for CDM projects, too.[113]

Again, the overall environmental impact of a proposed CDM project could be subject to a multiplier like the one proposed for the host country above. The general approach is easy to sketch: renewable energy projects such as solar or wind farm should receive full credits while reducing super-pollutants, developing CCS, and employing nuclear power should receive discounted credits. Hydroelectric dams should fall somewhere in between to balance their positive contribution to reducing greenhouse gases and their negative impacts upon biodiversity and displaced individuals. A more precise formula may be gleaned from the work of Steve Thorne and Stefan Raubenheimer on the SouthSouthNorth project. They have created an appraisal matrix that evaluates potential CDM projects based upon eight sustainability indicators (mitigation of climate change, local environmental sustainability, the balance of payments, macroeconomic sustainability, cost effectiveness, technological self-reliance, and sustainable use of natural resources) and ten feasibility indicators.[114] This matrix could be adapted

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[110] *See* UNFCCC, Approved Baseline and Monitoring Methodologies, http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html (last visited Oct. 14, 2009) [hereinafter Approved Baseline and Monitoring Methodologies] (listing the types of projects that are eligible for CDM funding).

[111] *See* David M. Driesen, *Sustainable Development and Market Liberalism's Shotgun Wedding: Emissions Trading Under The Kyoto Protocol*, 83 IND. L.J. 21 (2008) (criticizing the CDM's treatment of super-pollutants).

[112] *See* David A. Wirth, *The Sixth Session (Part Two) and Seventh Session of the Conference of the Parties to the Framework Convention on Climate Change*, 96 AM. J. INT'L. L. 648, 653 (2002) (explaining the exclusion of nuclear power from the CDM). China has built 11 nuclear power plants since 1993, with seven more under construction and ten about to begin construction. *See* Wang & Watson, *supra* note 73, at 52. None of those facilities have received any CDM funding.

[113] For a summary of the debate concerning CCS and the CDM, compare WORLD COAL INSTITUTE, CCS & THE CLEAN DEVELOPMENT MECHANISM: A SUBMISSION ABOUT CARBON DIOXIDE CAPTURE AND STORAGE IN GEOLOGICAL FORMATIONS AS CLEAN DEVELOPMENT MECHANISM (2009), *available at* http://www.worldcoal.org/bin/pdf/original_pdf_file/css_the_clean_development_mechanism%2803_06_2009%29.pdf (asserting that "CCS meets the objectives and criteria of the" CDM) with GREENPEACE INT'L, CLEAN DEVELOPMENT MECHANISM: NO PLACE FOR CARBON CAPTURE AND STORAGE (2008), http://www.greenpeace.org/raw/content/international/press/reports/CCS-CDM.pdf (objecting to CCS as unsafe and contrary to sustainable development).

[114] *See* Steve Thorne & Stefan Raubenheimer, *Sustainable Development (SD) Appraisal of Clean Development Mechanism (CDM) Projects – Experiences from the SouthSouthNorth (SSN) Project*, FORUM FOR ECON. & ENV'T – FIRST CONF. PROC 54, 58-62 (2001), *available at* http://www.econ4env.co.za/archives/ecodivide/Theme3a.pdf (listing the indicators); *see generally* SouthSouthNorth Clean Mechanism Development Projects, http://www.southsouthnorth.org/ (last visited Oct. 14, 2009) (describing the work of the SouthSouthNorth project on climate change mitigation and adaptation). Other proposals for multiplying or discounting the credits earned by CDM projects depending upon the type of technology employed appear in Bakker & Saidi, *supra* note 45, at 6-7, 28-29; Schatz, *supra* note 46, at 727-34; Schneider, *supra* note 60, at 28-30.

for use in evaluating the multiplied or discounted credits that each CDM project should receive.

The multiplier for each type of project would then be combined with the multiplier for each host country as follows:

	Brazil .67	Chad 1.60	China .94	Sudan 1.50
Wind Power 1.0	.67	1.60	.94	1.50
Hydroelectric Dams .75	.50	1.2	.71	1.13
CCS .50	.34	.80	.47	.75
Nuclear Energy 2.5	.17	.40	.24	.38

This formula would adjust the CDM to provide the most credits to the most environmentally-friendly projects in the least developed countries (e.g., wind power in Chad) and the least credits to the least environmentally-friendly projects in the most developed countries (e.g., nuclear energy in Brazil). The precise numbers should be decided by the parties to the UNFCCC or by the CDM's executive board, and then Annex I nations will know how many credits they can earn through different types of projects in different locations.

III. Conclusion

Hailed as a breakthrough in environmental policymaking, the CDM is expected to generate nearly three billion CERs by the time the regulatory obligations of the Kyoto Protocol expire in 2012.[115] Cameron Hepburn and Nicholas Stern thus praise the CDM as "the success story of carbon trading to date" because of the emissions it has reduced, the investment it has encouraged, and its ability to engage the developing world in the response to climate change.[116] There remain serious questions, however, concerning the actual emissions reductions that can be attributed to the CDM and the cost of achieving them. So the CDM is one of many aspects of the Kyoto Protocol that is being revisited in the negotiations toward a new climate change treaty.

Countless experts have offered their suggestions for that new treaty. Without reviewing them all here, it is apparent that the most significant challenge is to craft an agreement that engages the United States while retaining the involvement of China. The CDM may serve as a crucial bridge between those two countries, but the CDM should also recognize the importance of the Kyoto Protocol's goal of encouraging sustainable development throughout the world. There is a place for hydroelectric dams in China, but those dams come at a significant environmental and social cost even as less developed countries have been ex-

[115] *See* CDM Statistics, *supra* note 21.

[116] Hepburn & Stern, *supra* note 63, at 272.

cluded from the benefits of CDM investment. The changes proposed here are designed to account for those shortcomings, and to complement the other changes to the Kyoto Protocol that will inevitably result as the global community revisits it in light of the experience of the past several years.